Agribusiness

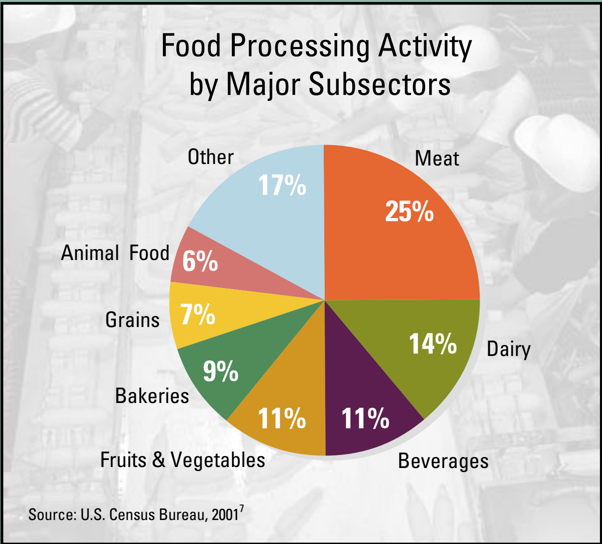
Sector At-a-Glance*

Number of Facilities:	21,000
Value of Shipments:	$480 Billion
Number of Employees:	1.5 Million

*All figures represent food processing segment of sector.
Source: U.S. Census Bureau, 2001[1]

Profile EPA's Sector Strategies Program defines the agribusiness sector broadly to include those business entities that most significantly affect how food is grown, processed, and distributed in the U.S. EPA is working with agribusiness stakeholders because of the major influence they have on the environmental practices of all segments of the food industry, from production to consumption. Diversified agribusiness companies such as Kraft Foods, Conagra, PepsiCo, Cargill, and Coca-Cola are some of the largest in the U.S.

Food processing[2] is the focal point for the agribusiness sector, given the predominant role that processors play in food production. Food processing companies convert raw fruits, vegetables, grains, meats, and dairy products into finished goods, ready for the grocer or wholesaler to sell to households, restaurants, or institutional food services. Food safety is an overarching objective that affects environmental planning and decisions in all facilities. Processing facilities address on-site environmental issues but also interact with farmers, livestock growers, distributors, and consumers in ways that can beneficially affect off-site environmental decisions.



Source: U.S. Census Bureau, 2001[7]

Although the food processing industry is comprised of large agribusiness corporations, there are more than 20,000 food processing establishments widely distributed throughout the country.[3] Two-thirds of all food processing companies have fewer than 20 employees.[4] Like many other industry sectors, the food industry has experienced consolidation and vertical integration in recent years.

Production Process The industry produces a diverse array of food products, each with its own unique production processes and environmental impacts.

Partnerships The Sector Strategies Program's working relationship with the agribusiness sector originated with the meat processing segment of the industry, represented by the American Meat Institute (AMI).[5] The National Food Processors Association (NFPA) is EPA's current partner in the Sector Strategies Program.[6]

Key Environmental Opportunities The agribusiness sector is working with EPA to improve the industry's performance by:

- Improving water quality;
- Managing and minimizing waste; and
- Improving performance of meat processors.

Improving Water Quality

In the food processing sector, water is an essential element of plant sanitation. Typical wastewater pollutants include biodegradable organics, oil and grease, and suspended solids. Food processors may be able to recover some of the fats, oils, and greases in their waste stream and sell them to renderers, and in some cases, treated water can be recycled for plant cleanup or other processing purposes. Federal data from approximately 400 food processors indicate a 44% decrease in wastewater discharges between 1994 and 2002, as plants looked for opportunities to conserve, recycle, or reuse water.[8]

Managing and Minimizing Waste

Food processors use and produce a variety of chemicals in their operations, including nitrate compounds, ammonia, ethylene glycol, methanol, n-hexane, and hydrochloric and sulfuric acid. More than 1,000 food processors report the release and management of these and other chemicals through EPA's Toxics Release Inventory (TRI). While normalized quantities of TRI releases increased, the normalized quantity of TRI releases and waste managed by food processing facilities decreased by 23% between 1993 and 2001.[9]

Improving Performance of Meat Processors

Ongoing projects with AMI and its member companies promote the use of environmental management systems (EMS) and stewardship in the supply chain.

Environmental Management Systems

Together with AMI member companies and the state of Iowa, the Sector Strategies Program developed a customized EMS Implementation Guide for meat processors.[10] Using the Guide as a basis, AMI developed the Master Achiever Pioneer Star (MAPS) Program, which provides a tiered approach to EMS development and performance recognition for AMI members.[11] Through their EMS:

- Advance Brands reduced the volume of caustic chemicals used to treat wastewater by 50%;[12] and
- Excel Corporation reduced solid waste volume by 28% in 2002-2003.[13]

Stewardship in the Supply Chain

Some of the larger meat processors are working with their agricultural and livestock suppliers to achieve better nutrient management.

Case Study: Comprehensive Nutrient Management Plans (CNMP)

Farmland Foods, Prestage-Stoecker Farms, and 19 of their suppliers are participating in an Iowa-based pilot project to voluntarily implement CNMPs at livestock facilities. So far, participating farms have improved nutrient application on nearly 4,500 acres, with an anticipated decrease in soil loss at some farms of more than 30%.[14]

Cement

Sector At-a-Glance	
Number of Facilities:	116
Value of Shipments:	$8.3 Billion
Number of Employees:	18,000

Source: U.S. Geological Survey, 2004[1]

Profile The cement sector[2] comprises 116 plants in 36 states that produce portland cement, which is used as a binding agent in virtually all concrete. Concrete, in turn, is used in a wide variety of construction projects and applications, ranging from patios and driveways, to stucco and mortar, to bridges and high-rise buildings.

Strong construction markets helped boost cement consumption in the 1990s. Between 1993 and 2001, the value of shipments more than doubled.[3] At the same time, the cement industry achieved increased efficiency by automating production and closing small facilities. As a result, the average cement kiln produces over 60% more cement today than 20 years ago.[4]

Production Process Cement is composed of four elements – calcium, silica, aluminum, and iron – which are commonly found in limestone, clay and sand. These raw materials undergo the following stages of processing in making portland cement:

- Crushing at the quarry and then proportioning, blending, and grinding at the facility;
- Preheating before entering the facility's rotary cement kiln – a long, firebrick-lined, steel furnace;
- Heating, or pyroprocessing, in the kiln, through which the raw materials become partially molten and form an intermediate product called "clinker"; and
- Cooling the clinker and grinding it with a small quantity of gypsum to create portland cement.

Partnership The Portland Cement Association (PCA) has formed a partnership with EPA's Sector Strategies Program to improve the environmental performance of the cement industry. PCA members operate more than 100 facilities and account for more than 95% of U.S. cement production.[5]

Key Environmental Opportunities The cement sector is working with EPA to improve the industry's performance by:

- Increasing energy efficiency;
- Reducing air emissions;
- Managing and minimizing waste; and
- Promoting environmental management systems.

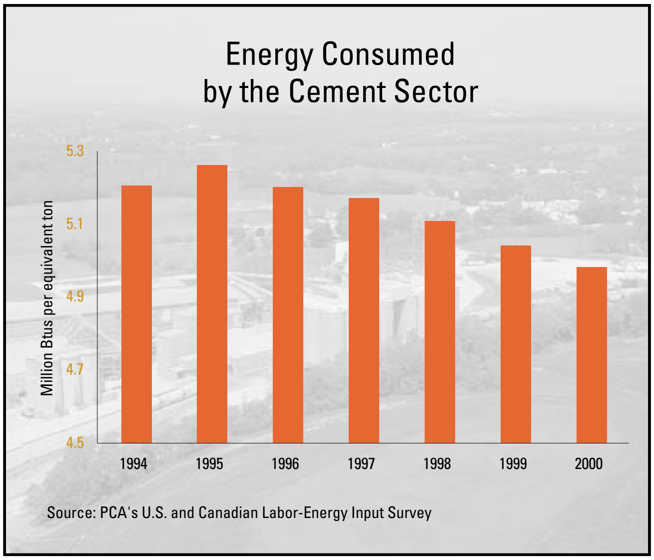
Increasing Energy Efficiency

Cement manufacturing requires thermochemical processing of substantial quantities of limestone and other raw materials in huge kilns at very high and sustained temperatures. Fueled by coal and petroleum coke, electricity, wastes, and natural gas, the sector uses a significant amount of energy in its production processes – an average of 5 million Btus per ton of clinker.[6]

The industry has made progress in reducing the amount of energy required to produce each ton of cement. Sector-wide energy usage fell 4% from 1994 to 2000, following a consistent trend of decreased energy usage that began in the early 1970s.[7] This continued decline is the result of industry's efforts to modernize plants by replacing older, more energy-intensive "wet" kilns with newer "dry" kilns. Wet kilns blend ground raw materials with an aqueous slurry that is then fed into a kiln, whereas dry kilns are fed their raw materials as a blended dry powder. On average, wet process operations use 34% more energy per ton of production than dry process operations.[8] Approximately 80% of U.S. cement capacity now relies on dry process technology.[9]

Case Study: Energy Star Partners

The cement sector is working with EPA's Energy Star program to develop tools to measure energy performance and to assign ratings to plants within the industry. Currently, 18 of the largest cement manufacturing companies are Energy Star partners. As partners, they have committed to measuring and benchmarking their energy performance, and developing and implementing plans to improve their performance.[10]



Reducing Air Emissions

Cement manufacturers are working to reduce emissions of nitrogen oxides (NO_X), sulfur dioxide (SO_2), particulate matter (PM), and greenhouse gases (GHG) from their operations.

Nitrogen Oxide Emissions

In cement manufacturing, the combustion of fuels at high temperatures in the kiln results in the release of NO_X emissions. Between 1996 and 2001, the normalized quantity of NO_X emissions from the cement sector fell by 3%.[11] Current NO_X emissions from the sector account for approximately 1% of total U.S. non-agricultural NOx emissions.[12]

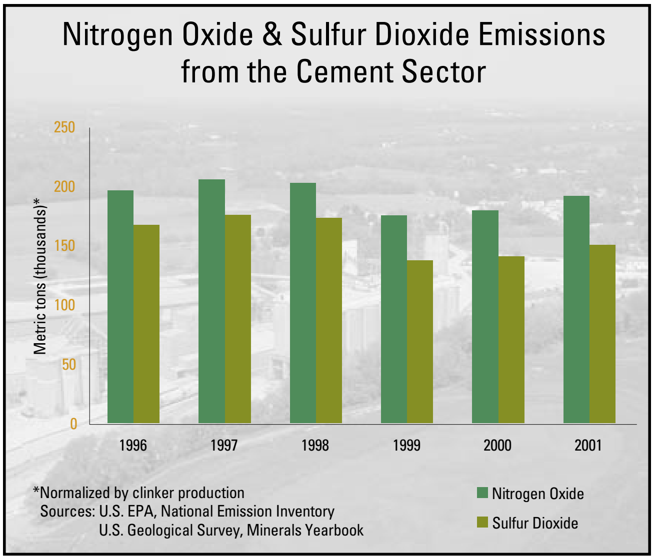
Sulfur Dioxide Emissions

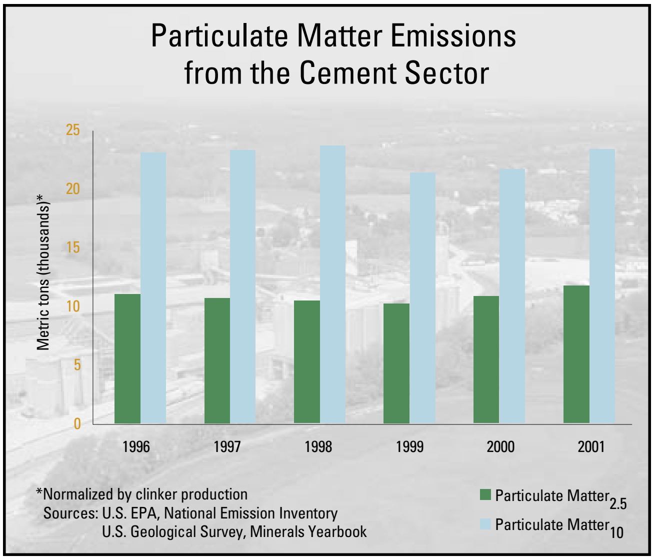
The combustion of sulfur-bearing compounds in coal, oil, and petroleum coke, and the processing of pyrite and sulfate in the raw materials, results in the release of SO_2 emissions from cement operations.

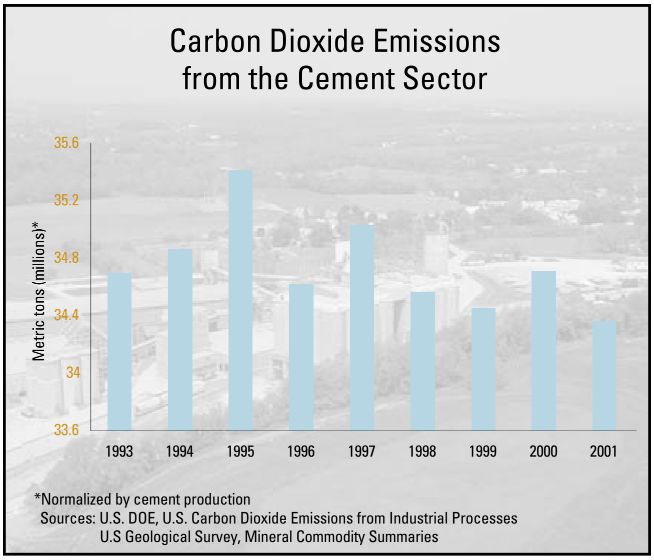
To mitigate these emissions, cement plants typically install air pollution control technologies called "scrubbers" to trap such pollutants in their exhaust gases. In addition, limestone used in the production process has inherent "self-scrubbing" properties, allowing the industry to handle high-sulfur fuels. Between 1996 and 2001, the normalized quantity of SO_2 emissions from the cement sector decreased by 10%.[13]

Particulate Matter Emissions

In cement manufacturing, quarrying operations, the crushing and grinding of raw materials and clinker, the kiln line, and cement kiln dust result in PM emissions. Between 1996 and 2001, the normalized quantity of PM_{10} emissions from the cement sector remained fairly constant, following marked improvements begun in the early years of Clean Air Act implementation..[14]







Greenhouse Gas Emissions

Approximately 98% of man-made carbon dioxide (CO_2) emissions come from the combustion of fuel, for a total of 5.8 million tons in 2002.[15] Of this percentage, about one-third is due to fuel combustion by motor vehicles, and another third comes from power plants. The cement sector contributes to 1.3% of the final third, with CO_2 emissions resulting from the burning of fossil fuels (predominantly coal) during pyroprocessing, and from the chemical reactions (calcination) that convert limestone into clinker.[16] In 2002, cement production resulted in more than 43 million metric tons of CO_2 emissions.[17]

In 2003, PCA formalized its commitment to CO_2 emissions reductions by joining Climate VISION, a voluntary program administered by the U.S. Department of Energy (DOE) to reduce GHG intensity (the ratio of emissions to economic output).[18] PCA has committed to a 10% reduction in CO_2 emissions per ton of product by 2020 (from 1990 levels).

Case Study: Voluntary Reporting of GHG Emissions

DOE's 1605(b) Voluntary Reporting of Greenhouse Gases Program:

- *Provides a tool for measuring GHG emission reductions;*
- *Collects voluntarily reported data on GHG emissions and activities aimed at reducing GHG emissions; and*
- *Gathers information on commitments to reduce GHG emissions and increase carbon sequestration.*[19]

Two participating Lehigh Cement facilities submitted reports in 2002 showing a combined emission reduction of more than 450,000 metric tons of CO_2 equivalent.[20]

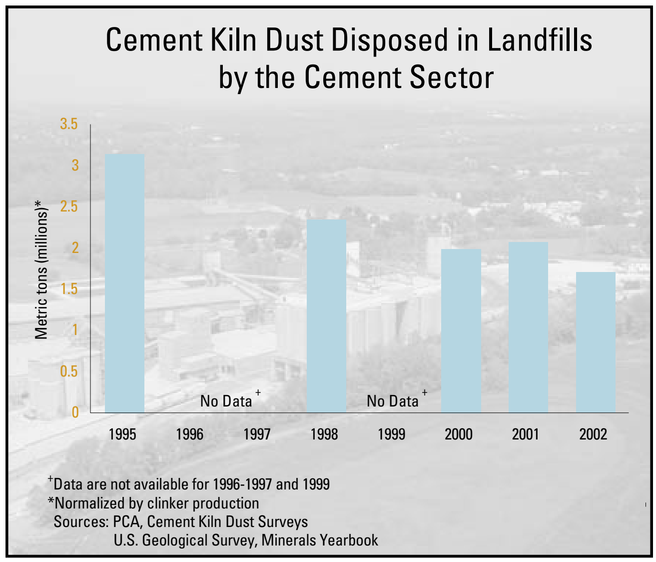
Managing and Minimizing Waste

Cement kiln dust (CKD) is the broad term that refers to particles released from the pyroprocessing line. CKD includes partially burned raw materials, clinker, and eroded fragments from the refractory brick lining of the kilns. Modern plants typically try to recover CKD, because it can be reused in the manufacturing process. Recycling CKD serves the environment by:

- Reducing the amount of raw materials needed;
- Reducing energy consumption, since the material is already partially processed; and
- Reducing health concerns associated with landfilling (e.g., the possible release of heavy metals and dust into the air and water).

Currently about two-thirds of the CKD generated is returned to the kiln for reuse in the manufacturing process.[21] The amount of CKD recycled continues to increase as old process lines are replaced or updated. There are limits to the recycling of CKD in the manufacturing process, however, because contaminants (such as alkalis) can build up in the CKD and compromise the quality of the clinker.

The CKD that is not recycled is either disposed at a landfill or sold to other sectors for "beneficial reuse" applications such as road fill, liming agent for soil, or stabilizer for sludges and other wastes. Between 1995 and 2002, the normalized quantity of CKD disposed dropped from 3.1 million metric tons to 2 million metric tons. During the same time period, beneficial reuse of CKD varied between 570,000 and 920,000 metric tons.[22]



Promoting Environmental Management Systems

Interest in environmental management systems (EMS) is increasing in the cement sector. PCA has begun discussing the development of an EMS program with its membership. Details of the program are expected to be announced in mid-2004.

Case Study: EMS at St. Lawrence Cement Group

In 2000, St. Lawrence Cement Group created a 5-year Sustainable Environmental Performance business plan, which identified key issues, opportunities, and actions to be integrated into its management framework. As part of the plan, St. Lawrence committed to:

- *Implementing an ISO 14001-certified EMS at all of its cement manufacturing and grinding facilities by the end of 2004;*
- *Reducing CO_2 emissions per ton of product by 15% by 2010 (from 2000 levels); and*
- *Reducing consumption of virgin raw materials per ton of product by 15% by 2007 (from 2000 levels).*

St. Lawrence has also implemented a corporate emission and reporting standard, which allows it to track energy consumption, air emissions, and CKD recycling across all of its facilities. The table below highlights the company's progress to date in these areas.[23]

Environmental Improvements at St. Lawrence Cement Group[24]

Performance Measure	2000	2002
Total cement production (million tons)	3.5	4.1
Electrical consumption (kwh/ton)	152	144
Heat consumption (gigajoules/ton)	3.94	3.48
CO_2 emissions (kg/ton)	792	704
NO_x emissions (kg/ton)	2.9	2.1
SO_2 emissions (kg/ton)	2.3	2.0
CKD previously disposed, then recycled (thousand tons)	50	24

Colleges & Universities

Sector At-a-Glance

Number of Institutions:	4,000*
Value of Revenues:	$260 Billion**
Number of Employees:	2.9 Million***

*Source: U.S. Census Bureau, 2001[1]
**Source: National Center for Education Statistics, 2003[2]
***Source: National Center for Education Statistics, 2001[3]

Profile The college and university sector[4] includes a wide variety of campuses across the country, from small community colleges to large research universities. Funding sources for the sector include tuition, private donations, government grants, and, for public institutions, state appropriations. In 2002, higher education institutions educated more than 15 million students. Enrollment is expected to increase to more than 18 million students by 2013.[5]

Campus Operations Classroom education is only one of many activities taking place on college campuses. Campuses often maintain other types of facilities, including research laboratories, art studios, utility generation and transmission plants, dormitories, and water distribution systems. Many large research institutions also have specialized facilities, such as medical centers, agricultural centers, nuclear reactors, and high security biomedical laboratories. Improving environmental performance on campuses offers a unique opportunity to raise awareness and instill knowledge about environmental issues in students.

Partnerships Six organizations have formed a partnership with EPA's Sector Strategies Program to improve the environmental performance of the college and university sector. These organizations are:

- American Council on Education (ACE);
- APPA: Association of Higher Education Facilities Officers;
- Campus Consortium for Environmental Excellence (C2E2);
- Campus Safety, Health and Environmental Management Association (CSHEMA);
- Howard Hughes Medical Institute (HHMI); and
- National Association of College and University Business Officers (NACUBO).[6]

Key Environmental Opportunities In 2003, EPA and the six partner organizations formed a performance measurement workgroup to select key environmental performance indicators, determine appropriate methodologies to measure these indicators, measure these indicators on their campuses, and develop tools to assist other institutions with the measurement process. The college and university sector is working with EPA to improve campus performance by:

- Increasing energy efficiency;
- Reducing air emissions;
- Managing and minimizing waste;
- Conserving water; and
- Promoting environmental management systems.

Increasing Energy Efficiency

Energy consumption is one of the largest environmental impacts of college campuses. New construction, aging infrastructure, financial constraints, and increasing energy costs are motivating institutions to re-evaluate their energy infrastructure. The U.S. Department of Energy estimates that at least 25% of the $6 billion colleges and universities spend annually on energy could be saved through better energy management.[7]

In order to reduce the costs and environmental impacts associated with energy use, colleges and universities across the country are undertaking a variety of energy conservation activities.

Case Study: Energy Star Partners

As EPA Energy Star partners, more than 200 colleges and universities have committed to measure their energy consumption and develop and implement plans to improve their energy performance.[8]

In 2002, one Energy Star partner, Dutchess Community College (DCC) in Poughkeepsie, NY, invested in energy efficiency by signing a $2.4 million performance-based contract that included replacing a 500-ton electric chiller, an industrial-scale water-cooling mechanism used to air condition four buildings on campus, with two new 300-ton gas-engine powered chillers. As a result, the college has already reduced energy use by 13%. Over the next 15 years, DCC expects to save more than 830,000 kilowatt-hours per year in energy, for a total of $1.2 million savings in energy costs.[9]

Case Study: Energy Efficiency at the University of Florida

The University of Florida (UF) in Gainesville, FL, embarked on an energy efficiency campaign in the mid-1990s. With the leadership of the vice-president for finance and administration, UF began a two-year, $6 million project to improve the scheduling and controlling of the campus' energy demands. The project resulted in over $2 million net savings. Over five years, UF's total and per capita energy consumption decreased by almost 25%.[10]

Reducing Air Emissions

Many colleges and universities are committed to reducing greenhouse gas (GHG) emissions resulting from power plants, electricity use, and fleet vehicles on campus. For example:

- The presidents of all 56 New Jersey colleges and universities have endorsed a Sustainability Greenhouse Gas Action Plan for New Jersey that calls for a 3.5% reduction in the state's GHG emissions by 2005.[11]
- The University of Florida in Gainesville, FL, is pursuing an aggressive goal of becoming "carbon-neutral" by the year 2030 through an effort to offset campus GHG emissions with projects that cut down GHG emissions by an equal amount.[12]

Managing and Minimizing Waste

Many colleges and universities are working to reduce generation and increase recycling of hazardous and solid wastes on their campuses.

Hazardous Waste Minimization

Colleges and universities produce hazardous waste in campus laboratories, medical centers, and art studios, as well as during operations and maintenance of buildings and vehicles, and construction. Many campuses are implementing hazardous waste reduction programs to cost-effectively decrease the amount of hazardous wastes on campuses while supporting a mission of research and education. Measuring reductions of hazardous waste on campuses poses some unique challenges, because the quantities and types of chemicals used are constantly changing in dynamic research environments.

Case Study: Waste Minimization at the University of Michigan

Over the past decade, research funding at the University of Michigan (UM) in Ann Arbor, MI, has grown 129%. Consequently, research laboratory space has increased by 47%, and waste generation has increased correspondingly.

In an effort to bring waste volumes and cost under control, UM launched a formal waste minimization program in 1995. UM is utilizing many different tools, including:

- *Education (including micro-teaching techniques);*
- *Protocol review;*
- *Non-hazardous product substitution;*
- *Solvent distillation systems;*
- *Chemical tracking systems; and*
- *Chemical redistribution programs.*

Though overall waste generation continued to increase through 2002, a decrease began in 2003 as many of these programs began to take full effect. The table below displays some of the program's successes. The program has proven to be cost-effective, saving more than $200,000 annually in disposal costs and the need to purchase new chemicals.[13]

UM's Waste Minimization Initiatives[14]

Chemical Type	Waste Minimization Method	Annual Reduction
Acetone, Xylene, Alcohols	Distillation	5,500 gallons
Ethidium Bromide	Filtration	100 gallons
Photo Processing Waste	Silver Recovery	800 gallons
Acids, Bases, Solvents	Micro-Teaching Techniques	300 gallons
Varied	Chemical Redistribution	400 bottles
Varied	Chemical Tracking/Sharing	210 gallons
Elemental Mercury Equip.	Mercury-Free Replacement	2,200 pounds
Varied	Aqueous-Based Substitution	20 gallons

Solid Waste Recycling

Solid wastes from colleges and unversities include common recyclables, such as cans, glass, cardboard and office paper; and compostables, such as food scraps, animal bedding, landscape refuse, and trash. An increasing number of colleges and universities are reducing their solid waste volumes through recycling.

Case Study: College and University Recycling Council

The National Recycling Coalition's College and University Recycling Council is a network of campus-based recycling professionals with a mission to organize and support environmental program leaders in managing resources, recycling, and waste issues.

The Council created an on-line benchmarking tool so that colleges and universities can compare their performance with other schools and quantify the aggregate benefits of campus resource management and recycling programs. The 100 Council members are encouraged to share their progress with the public. In 2002, 20 schools posted information on-line about the amount of recyclables, compostables, and trash collected on their campuses.[15]

Conserving Water

Water conservation efforts on campuses often include simple activities, such as conserving water at the faucet, reusing landscaping water, and implementing more efficient methods of heating and cooling buildings.

Case Study: Water Conservation at the University of Colorado

In 2001, the University of Colorado, in Boulder, CO, began several water conservation projects, including:

- *Installing temperature sensor and control valves on two furnaces;*
- *Replacing water-driven aspirators with vacuum pumps in laboratories; and*
- *Decreasing the amount of water used for irrigation.*

As a result of these and other projects, total annual water usage decreased by 11% between 2001 and 2002, saving the university approximately $170,000.[16]

Promoting Environmental Management Systems

Colleges and universities are increasingly utilizing systematic approaches, such as environmental management systems EMS, to meet environmental challenges. Campus-wide EMS can assist colleges and universities in making measurable progress toward environmental goals.

Case Study: Washington State University's Campus-wide EMS

In 1999, Washington State University (WSU) in Pullman, WA, implemented one of the first campus-wide EMS. Since that time, WSU has experienced a number of environmental benefits in areas such as recycling and energy. Between 2001 and 2003, WSU experienced a 56% increase in recycling. A number of energy conservation projects have also led to the conservation of 3.6 million kilowatt-hours of energy per year. Through its EMS, WSU has also committed to reduce nitrogen oxide emissions by more than 50% and sulfur dioxide emissions by more than 85% by 2005.[17] *In 2003, WSU became the first university to be accepted into EPA's National Environmental Performance Track.*[18]

Construction

Sector At-a-Glance

Number of Companies:	700,000*
Value of Construction:	$850 Billion**
Number of Employees:	6.5 Million*

*Source: U.S. Census Bureau, 2001[1]
**Source: U.S. Census Bureau, 2002[2]

Profile The construction sector[3] comprises general and specialty contractors, which are predominantly small businesses that can be found across the country. The construction sector can be divided into three major segments:

- Building construction;
- Heavy and civil engineering construction, including highways, bridges, and other public works; and
- Specialty trade contractors, such as plumbing, mechanical, and electrical contractors.

In the last ten years, employment in the construction sector increased more than 40%.[4] New orders for construction materials and supplies in 2003 totaled $420 billion, which is nearly 11% of total U.S. manufacturing orders.[5]

Building Process Contractors perform a wide variety of activities, from building roads to golf courses to buildings. While the production processes for the construction sector vary greatly depending upon the project, the following steps are often standard across projects:

- Project planning and design;
- Permitting;
- Material selection;
- Demolition and/or excavation;
- Security;
- Construction; and
- Inspections.

Partnership The Associated General Contractors of America (AGC) has formed a partnership with EPA's Sector Strategies Program to improve the environmental performance of the construction industry. AGC's 35,000 members represent all segments of the construction industry except single-family housing.[6]

Key Environmental Opportunities The construction sector is working with EPA to improve the industry's performance by:

- Managing and minimizing waste;
- Encouraging green construction;
- Improving water quality;
- Reducing air emissions; and
- Promoting environmental management systems.

Managing and Minimizing Wastes

Construction provides opportunities for recycling wastes and reusing byproducts.

Construction and Demolition Debris

Construction and demolition (C&D) debris refers to materials produced in the process of construction, renovation, and/or demolition of buildings, roads, and bridges. C&D debris typically includes concrete, asphalt, wood, gypsum wallboard, paper, glass, rubble, and roofing materials. Land clearing debris, such as stumps, rocks, and dirt, may also be included in some state definitions of debris. In most cases C&D debris is non-hazardous.

C&D debris is a significant issue in the U.S. because of the enormous volume generated. In 1996, the construction, renovation, and demolition of buildings generated more than 136 million tons of C&D debris.[7] Although 20-30% of C&D debris is recovered for processing and recycling, the majority (70-80%) ends up in municipal solid waste landfills or in special C&D landfills.[8]

Green construction projects have demonstrated that, in some instances, 70% or more of C&D debris can be recycled, with resultant savings in landfill space, virgin resources, and disposal costs.[9] As a result, EPA and its partners are seeking ways to encourage recycling of C&D debris. EPA's Resource Conservation Challenge (RCC) is promoting research and development of best practices for C&D debris reduction and recovery.[10] In addition, the Sector Strategies Program, RCC, and AGC are gathering data on the extent of C&D recycling and strategizing how best to encourage greater recycling rates.

Beneficial Reuse of Industrial Byproducts

The construction sector is also exploring the potential for beneficial reuse of its byproducts, as well as those of other sectors. Examples include hardwood byproducts, plant trimmings, sewage sludge, steel slag, and spent non-hazardous foundry sand.

Case Study: Beneficial Reuse by Kurtz Brothers, Inc.

An estimated 80% of spent sand from foundries, valued at approximately $125 million, is landfilled each year. Kurtz Brothers, Inc., a contractor in Independence, OH, diverted more than 150,000 tons of non-hazardous spent foundry sand from landfills by using it in several recent construction projects for the Ohio Turnpike Commission. For example, Kurtz Brothers utilized nearly 54,000 tons of spent foundry sand in a terraced, landscaped embankment near a bridge over the Cuyahoga River.[11]

Encouraging Green Construction

In the U.S., residential and commercial buildings account for:

- 36% of total energy use;
- 65% of electricity consumption;
- 30% of greenhouse gas emissions; and
- 12% of potable water consumption.[12]

Buildings built to "green" standards use natural resources like energy, water, materials, and land much more efficiently than conventional buildings. As well as being environmentally preferable, green buildings can also be cost-efficient. A recent study found that some investments in green buildings have paid for themselves 10 times over through reduced operations, maintenance, and utility costs.[13]

The Leadership in Energy & Environmental Design® (LEED) Green Building Rating System is a nationally accepted standard for green buildings. In order to be LEED® certified, a building project must demonstrate performance in five areas: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality.[14] Many federal agencies and private customers now require all new construction or major renovations to meet LEED® requirements.

Green construction practices, such as using recycled materials, recycling C&D debris, and preventing stormwater pollution, are essential elements in green building design. EPA and AGC are working together to make a variety of green construction resources available to the sector through the Web. The EPA-sponsored Construction Industry Compliance Assistance Center provides an overview of green buildings and will soon include links to state and local green building programs.[15] AGC's Environmental Services Web page also offers resources, including the "Green Construction Bible" and a tutorial about the LEED® rating system.[16]

Case Study: Green Construction of EPA Buildings

EPA recently completed the construction of two green buildings – the New England Regional Laboratory (NERL) in Chelmsford, MA, and the National Computer Center (NCC) in Research Triangle Park, NC.

During the construction of NERL, Erland Construction Inc., of Burlington, MA, diverted an estimated 200 tons of materials from a landfill, including approximately 250,000 pounds of fly ash and almost 8,000 yards of blasted ledge, which were processed on-site and then used in the building, the road's subgrade, and a retaining wall.[17]

During planning and construction of NCC, Skanska USA Building, Inc.:

- *Oriented the building to reduce heating and cooling loads;*
- *Designed landscaping to reduce heat islands;*
- *Consolidated parking areas to minimize site disturbance;*
- *Utilized building products made from recycled content; and*
- *Shipped many materials back to their original manufacturers or to recycling facilities, rather than to a landfill.*[18]

Improving Water Quality

Stormwater runoff from construction activities can have a significant impact on water quality. EPA regulations require operators of construction sites one acre or larger to obtain authorization to discharge stormwater under a National Pollutant Discharge Elimination System construction stormwater permit. Such permits typically include best management practices (BMPs) to reduce erosion and sediment runoff. Examples of BMPs include:

- Installing silt fencing;
- Providing vegetative buffers along waterbodies;
- Covering or seeding all dirt stockpiles; and
- Protecting storm drain inlets to filter out trash and debris.

Reducing Air Emissions

Many construction vehicles and equipment, such as earth moving equipment, generators and compressors, are powered by diesel engines. Exhaust from diesel engines contains particulate matter (PM), nitrogen oxides (NO_X), and toxic air pollutants. Together, construction and mining equipment account for 46% of total nonroad diesel emissions.[19]

On a national basis, the strategy for controlling air pollution from diesel engines involves low-pollution requirements for new diesel engines and rules covering the fuel used by these engines. Diesel engines on existing equipment will not be subject to the new regulations, yet may remain in operation for another 25 to 30 years. Therefore, EPA and its partners are encouraging firms to retrofit existing diesel vehicles with pollution controls through the Voluntary Diesel Retrofit Program. This program seeks immediate emission reductions by promoting innovative retrofit technologies, idle reduction, cleaner fuels, and cleaner engines.[20]

Case Study: Diesel Retrofit Partnership

To achieve statewide reductions in NO_X and PM, the California Air Resources Board established a $68 million fund to assist contractors in re-powering their heavy-duty diesel equipment with new engines capable of meeting more stringent NO_X and PM standards. In 2001, AGC of California teamed up with California Caterpillar Dealers to organize a seven-year project called "Re-powering for Tomorrow" to utilize state funds to re-power equipment. Over the course of the project, participants expect to reduce annual NO_X emissions by 1,200 tons and annual PM emissions by 90 tons.[21]

Promoting Environmental Management Systems

Interest in environmental management systems (EMS) is increasing rapidly within the construction sector. To date, three individual construction companies have been accepted into EPA's National Environmental Performance Track. In addition, AGC is a Performance Track Network Partner committed to encouraging top environmental performance through EMS.[22]

To increase EMS adoption by its members, AGC is currently developing an EMS Implementation Guide for the construction industry. Once the Guide is complete, the Sector Strategies Program will partner with AGC to train contractors across the country in EMS.

Many construction companies see EMS as a valuable tool for performance improvement.

Case Study: EMS at Skanska USA Building

In 1998, Skanska USA Building, Inc., made a company-wide commitment to implement an ISO 14001-compliant EMS. Through its EMS, Skanska:

- *Increased recycling and reuse of construction materials, for a savings of close to $1 million;*
- *Diverted 980 tons of debris from landfills (all from one construction site);*
- *Minimized soil erosion on all of its construction sites; and*
- *Reduced air emissions through 220,000 automobile miles avoided in one year by encouraging employees to carpool and ride mass transit.*[23]